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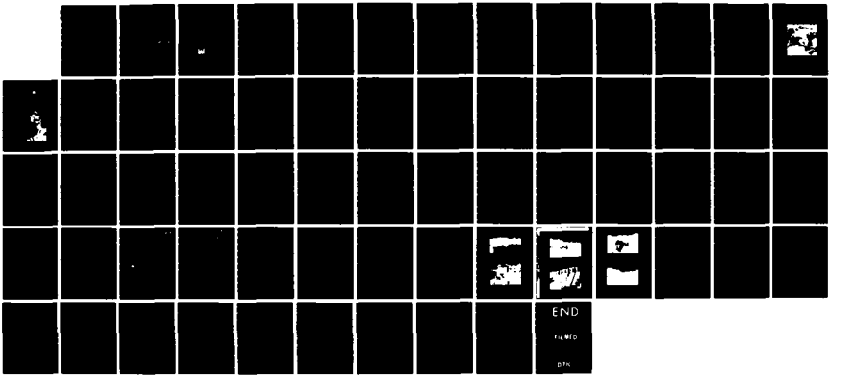

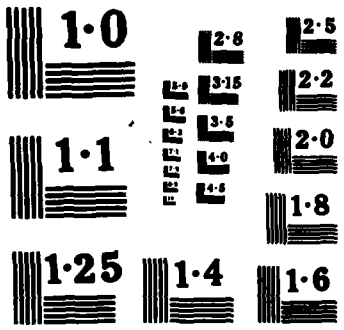
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TAUNTON RIVER BASIN
TAUNTON, MASSACHUSETTS

MILL RIVER DAM
MA 00813

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

APRIL 1979

UNCLASSIFIED

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Taunton River Basin
Taunton, Massachusetts
Mill River-Tributary of the Taunton River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam consists of a 120 ft. long spillway which was originally built in 1932. There are deficiencies which must be corrected to assure the continued performance of the dam. Generally, the dam is in poor condition. It has been classified as small in size with a hazard potential of high. A test flood equal to one half the probable maximum flood. Recommendations were presented for constructing additional spillway capacity at both Morey's Bridge and Mill River dams. These recommendations have not been implemented.

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MILL RIVER DAM

MA 00813

TAUNTON RIVER BASIN
TAUNTON, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION
PROGRAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00813

Name of Dam: Mill River

Town: Taunton

County and State: Bristol County, Massachusetts

Stream: Mill River - Tributary of the Taunton River

Date of Inspection: November 30, 1978

Mill River Dam consists of a 120-foot long spillway which was originally built in 1832. The spillway is constructed of a rockfill base, faced with unreinforced concrete on the crest and downstream slope. A timber structure above the crest contains a wooden walkway and guideposts for six bays of stoplogs, 23 bays of abandoned slide gates, and a sluice gate. After a flood in March 1968, the upper portions of the slide gates and the sluice gate were cut off, and most of the operating mechanisms were removed. The only potentially operable gate is the sluice gate which is rusted and has not been used since 1970. Discharge is over the stoplogs and over the tops of the abandoned slide gates, which vary from elevation (El) 58.9 to 59.6. The effective length of the spillway is 91 feet. The outlet at the dam is a sluiceway through the spillway and is located 30 feet from the east abutment. Flow is through a 3-foot wide by 4-foot high opening controlled by a sluice gate. The invert is at El 49.3. The downstream channel has vertical, dry-stone masonry side walls. The channel is 120 feet wide at the dam, narrowing to 37 feet at 240 feet downstream.

There are deficiencies which must be corrected to assure the continued performance of this dam. This conclusion is based on the visual inspection of the site, a review of available data, and a review of operating and maintenance procedures. Generally, the dam is in poor condition.

MILL RIVER DAM

The following deficiencies were observed at the site: 23 inoperable slide gates, deterioration of the timber walkway over the spillway, leakage around and between the stoplogs and the abandoned slide gates, poor condition of the operating mechanism for the sluice gate, brush growth along the walls of the downstream channel, and collapsing stonework in the walls of the downstream channel and in the west wall upstream of the dam.

Based on the Corps of Engineers' guidelines, the dam has been classified as "small" and in the "high" hazard category. Accordingly, a test flood equal to one-half the probable maximum flood was used for this analysis. Hydraulic analyses indicate that the spillway (with all gates closed and stoplogs in place) can discharge 660 cfs with the pond at El 61.1, which is the east abutment of the spillway. A test flood outflow of 2,460 cfs (one-half the Probable Maximum Flood (PMF)) at El 63.1 will overtop the abutments by a maximum of 2 feet. The spillway (with all gates closed) can discharge 27 percent of the test flood outflow before the dam is overtopped. If all the gates were opened and all stoplogs removed by the time the pond level reached El 59.5, the spillway could discharge 2,460 cfs with the pond at El 60.8, which is 0.3 feet below the east abutment of the spillway. At the present time, the gates cannot be opened.

A report dated June 13, 1973, to the Commonwealth of Massachusetts, Department of Public Works, Division of Waterways on Morey's Bridge and Whittenton (Mill River) Dams in Taunton, Massachusetts was prepared by Metcalf & Eddy, Inc. Recommendations were presented for constructing additional spillway capacity at both Morey's Bridge and Whittenton (Mill River) Dams. These recommendations have not been implemented.

The spillway discharge capacity is not considered adequate. Therefore, further hydrologic and hydraulic studies are required to determine what alternative measures are necessary to significantly increase the discharge capabilities at the dam and reduce the overtopping potential. The Owner should employ the services of a qualified consultant to conduct these additional hydrologic/hydraulic studies, including an evaluation of the recommendations in the report by Metcalf & Eddy, Inc.

The Owner should also accomplish the following: restore the abandoned slide gates to operating condition, repair the timber walkway over the spillway, restore the gate on the sluiceway to operating condition, remove brush growing on the sides of the downstream channel, and repair stonework in the walls of the downstream channel and in the west wall upstream of the dam. The Owner should also implement a regular program of inspection and maintenance and a warning system for the dam.

The remedial measures outlined above and in Section 7 should be implemented by the Owner within a period of one year after receipt of this Phase I Inspection Report. The Owner should immediately remove all of the abandoned slide gates on the spillway and lower the pond to El 55.1. The pond should be maintained at this level until the recommendations and remedial work have been completed. An alternative to these recommendations would be to drain the pond and remove the entire dam.

Edward M. Greco, P.E.
Project Manager
Metcalf & Eddy, Inc.

Connecticut Registration
No. 08365

Approved by:

Stephen L. Bishop, P.E.
Vice President
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 19703

This Phase I Inspection Report on Mill River Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

FRED J. RAVENS, JR., Member
Chief, Design Branch
Engineering Division

SAUL C. COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general conditions and the downstream damage potential.

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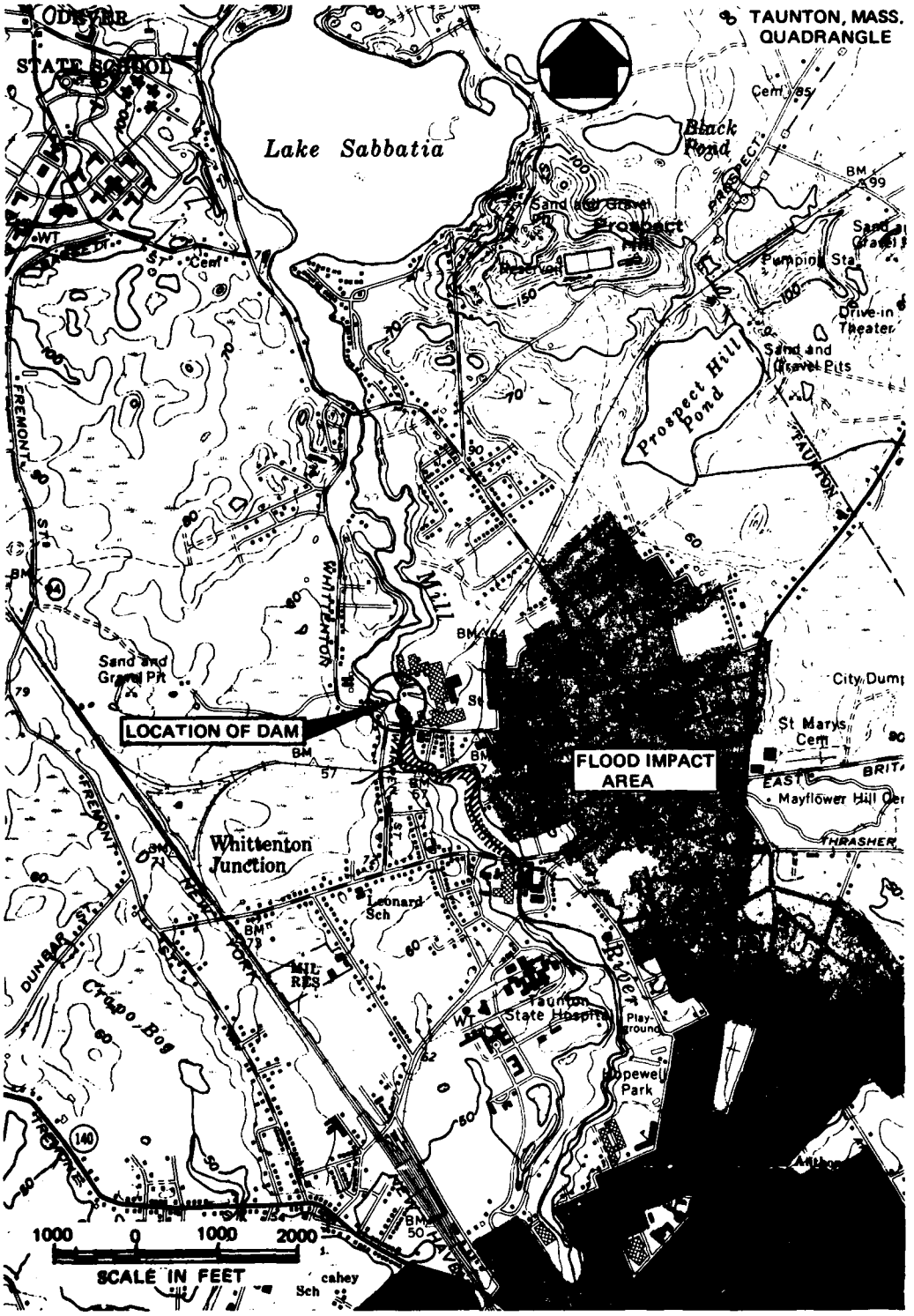
MILL RIVER DAM
TAUNTON, MASSACHUSETTS



LOCATION MAP – MILL RIVER DAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

MILL RIVER DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Divison of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Contract No. DACW 33-79-C-0016, dated November 28, 1978, has been assigned by the Corps of Engineers for this work.

b. Purpose:

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The dam is located on Mill River, a tributary of the Taunton River, in the City of Taunton, Bristol County, Massachusetts (see Location Map).

b. Description of Dam and Appurtenances. Mill River Dam, also known as Whittendon Dam, consists of a 120-foot long spillway with vertical, dry-stone masonry abutments (see Figures B-1, B-2, and B-3). The base of the spillway is a rockfill embankment, containing a binder of mortar or concrete. The crest and downstream slope are covered with a thin layer of unreinforced concrete. The concrete crest is 2 feet wide and varies from El 55.1 to 58.2. The upstream and downstream slopes both range from 1:1 to 2:1 (horizontal to vertical). Large, cut rock blocks are located along the downstream toe of the dam to prevent erosion.

A wooden walkway over the spillway contains guideposts for 30 bays along the crest and diagonal bracing from the walkway to the downstream toe of the dam (see sections on Figures B-1 and B-2). The first six bays from the east abutment contain wooden stoplogs 1.5 feet high. The remaining bays contain 23 abandoned wooden slide gates and a sluice gate. The upper portions of all the gates have been cut off, so that water flows over the tops, and they serve as stoplogs. The tops of the stoplogs and gates are at El 59.6 in Bays 1 through 9 from the east abutment, and at El 58.9 in Bays 10 through 30.

All but three of the gates have had their stems and operating mechanisms removed. Two gates in the seventh and ninth bays from the east abutment have stems but no operating mechanisms. The sluice gate in the eighth bay still has a stem and a rack and pinion mechanism mounted on the overhead walkway. This gate controls flow into a sluiceway cut through the spillway. The gate opening is 3 feet wide and 4 feet high with an invert at El 49.3. The sides of the sluiceway are made of timber sheeting and the floor is made of concrete.

There is a 36-inch intake upstream of the dam. The Owner reports that the intake supplies 0.3 to 0.4 million gallons per day (mgd) to textile mills which are located near the east abutment of the dam.

Flow over the spillway enters a downstream channel with vertical, dry-stone masonry side walls and a natural streambed. The channel is 120 feet wide at the dam and decreases to 37 feet wide at about 240 feet downstream. The side walls are 11 to 12 feet high near the dam and 6 to 8 feet high farther downstream. The channel extends 365 feet downstream to Whittendon Street. Water flows beneath the roadway in two 7-foot by 19.5-foot box culverts, and then enters a natural stream channel.

c. Size Classification. Mill River Dam is classified in the "small" category since it has a maximum height of 12 feet and a maximum storage capacity of 210 acre-feet.

d. Hazard Classification. A large complex of mill buildings and a parking lot are located adjacent to and nearly level with the east abutment of the dam. About 275 feet downstream of the dam, there are two office buildings along the east side of the channel, and about 7 feet above the streambed. About 365 feet downstream of the dam, Whittendon Street, a two-lane roadway, crosses over Mill River on a 12-foot high embankment. Below Whittendon Street, the river flows through thickly developed areas along its east bank and through a complex of factory buildings 3,000 feet downstream of the dam.

Complete failure of the dam would produce a water level at about El 60 at the Whittendon Street Bridge (see flood impact area shown on the Location Map). Flooding of buildings along the east wall of the downstream channel could endanger more than a few lives and cause an excessive amount of property damage. The bridge embankment at Whittendon Street could mitigate the effects of the flood wave farther downstream. However, some flooding of the thickly developed areas downstream of the bridge could also occur. Accordingly, the dam has been placed in the "high" hazard potential category.

e. Ownership. The dam is owned by L&O Realty Trust, 437 Whittendon Street, Taunton, Massachusetts 02780. Mr. David Olken, trustee,

(telephone 617-823-0741) gave permission to enter the property and inspect the dam.

f. Operators. The Owner is the operator of this dam.

g. Purpose of Dam. Water impounded by the dam is used in the manufacturing process and for fire protection at textile mills located near the east abutment. Upstream of the dam, a 36-inch intake supplies 0.3 to 0.4 mgd to the mills. The intake also leads to two pumps which can be used for fire protection at the factories and to supplement the City supply for fire protection.

h. Design and Construction History. Previous inspection reports state that the dam was originally constructed in 1832. A report dated 1973 indicates that the dam was rebuilt in 1882. According to the Owner, the dam was again reconstructed about 40 years ago and a plan dated 1935 (see Figure B-3) shows that some timbers were to be replaced on the gates and bracing. An inspection report dated 1959 (see page B-5) states that at that time, the dam was in fair condition but needed to be examined structurally and hydraulically.

In March, 1968, a flood occurred causing a 2.5-foot rise in the water level at the dam. Repairs were made in 1969-1970, including addition of rock and a concrete slab on the downstream face of the dam. The tops of the slide gates and sluice gate were cut off to maintain a lower water level. Since that time, Mill River Dam has functioned only as an ungated spillway, and the pond level is controlled by operating gates at Morey's Bridge Dam located upstream. Discharges under normal conditions are into Mill River from Morey's Bridge Dam.

In July, 1970, the dam was again inspected and found to be in fair condition. Gates were leaking and severe seepage was occurring at the downstream toe (see page B-4). The Massachusetts Division of Waterways was authorized to study the feasibility of reconstructing

both Mill River (Whittendon) and Morey's Bridge Dams. Hydraulic and stability analyses were presented in a report by Metcalf & Eddy, Inc., dated June 13, 1973. It was recommended that all gates be restored and a new spillway be constructed at Mill River (Whittendon) Dam. These recommendations were never implemented.

i. Normal Operating Procedure. There are no operating procedures at this dam. The water level in the pond can be controlled by operating gates at Morey's Bridge Dam located about 1 mile upstream. Personnel from L&O Realty Trust reportedly observe the water level daily upstream of Morey's Bridge Dam and operate the gates as necessary to prevent flooding of homes around Lake Sabbatia.

1.3 Pertinent Data

a. Drainage Area. The approximately 26,560-acre (41.4 square mile) drainage area includes the drainage areas of the Canoe River, Mulberry Brook and Snake River. There are nine dams plus three other control points for drainage in the watershed, as indicated on the map of the drainage area (see Figure D-1).

The land in the watershed is gently rolling and mostly wooded. There is light residential and commercial development with local areas of moderate development, such as around Lake Sabbatia and around the pond upstream of Mill River Dam. There is also a large area of swamp known as Hock Mock Swamp in Taunton and a series of cranberry bogs downstream of Harcourt Reservoir in Easton.

b. Discharge. Normal discharge is over the tops of abandoned slide gates, a sluice gate and stoplogs mounted in 30 bays on the crest of the spillway. The full length of the spillway is 120 feet, and the combined lengths of the bays is 91 feet. The crest of the spillway varies from El 55.1 to 58.2, and the top of the gates and stoplogs varies from El 58.9 to 59.6.

Water flows down a 1:1 to 2:1 slope on the downstream face of the spillway which is

covered with concrete. The downstream channel has a natural streambed with vertical, dry-stone masonry walls 6 to 11 feet high. The channel is 120 feet wide at the spillway and narrows to 37 feet wide at about 240 feet downstream. At about 365 feet downstream, flow passes through two 7-foot by 19.5-foot box culverts beneath Whittendon Street. The inverts of the culverts are at El 46.0, indicating the streambed slopes at a gradient of 1 percent.

The spillway (with all gates closed and stoplogs in place) can discharge an estimated 660 cfs with the water surface at El 61.1 which is the low point on the abutment of the spillway. The outflow test flood (one-half PMF) is 2,460 cfs at El 63.1. The spillway can discharge 27 percent of the Test Flood outflow before the dam is overtopped. If all gates were open and all stoplogs removed by the time the pond level reached El 59.5, the spillway could discharge 2,460 cfs with the pond at El 60.8 which is 0.3 feet below the east abutment of the spillway. At the present time, the gates cannot be opened.

The maximum flood level at the dam is unknown. In January 1979, the dam was not overtopped since the Owner removed boards from the tops of the abandoned slide gates in anticipation of heavy rainfall. A report dated 1973 states that during the March 1968 storm, the water level of the pond was at El 61.4. The discharge at that time is unknown, however, if all the gates were open and the stoplogs removed, the discharge is estimated to have been about 2,900 cfs.

c. Elevation (feet above Mean Sea Level (MSL)). A benchmark was established at El 61.09 on the east abutment of the dam. This elevation was shown on a drawing of the dam dated February, 1973.

(1) Top dam: 61.1 east abutment of spillway
61.8 west abutment of spillway

(2) Test flood pool: 63.1

(3) Design surcharge (original design): Unknown

(4) Full flood control pool: Not Applicable (N/A)

(5) Recreation pool: N/A

(6) Spillway crest: 58.9 to 59.6 top of stoplogs and gates; 55.1 to 58.2 concrete crest

(7) Upstream portal invert diversion tunnel: N/A

(8) Streambed at centerline of dam: 49.0

(9) Maximum tailwater: 48.6 water surface downstream of dam

d. Reservoir

(1) Length of maximum pool: 4,100 feet

(2) Length of recreation pool: N/A

(3) Length of flood control pool: N/A

e. Storage (acre-feet)

(1) Test flood surcharge (Net): 94 at El 63.1

(2) Top of dam (El 61.1): 160

(3) Flood control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest (El 58.9): 115 (with stoplogs/gates)

f. Reservoir Surface (acres)

*(1) Top dam: 23

*Based on the assumption that the surface area will not significantly increase with changes in reservoir elevation from 58.9 to 61.1.

*(2) Maximum pool: 23

(3) Flood control pool: N/A

(4) Recreation pool: N/A

(5) Spillway crest: 23

g. Dam (dam consists of a spillway)

(1) Type: Spillway made of rockfill base faced with concrete on crest and downstream slope

(2) Length: 120 feet

(3) Height: 12 feet to top of abutment

(4) Top width: 2 feet - concrete crest

(5) Side slopes: 1:1 to 2:1, upstream to downstream

(6) Zoning: Unknown

(7) Impervious core: Unknown

(8) Cutoff: Unknown

(9) Grout curtain: Unknown

i. Spillway

(1) Type: 30 bays of stoplogs and gates mounted on rockfill and concrete base.

(2) Length of weir (effective length): 91 feet

(3) Crest elevation: 58.9 to 59.6 top of stoplogs/gates; 55.1 to 58.2 concrete crest

(4) Gates: 23, one may be operable

(5) Upstream channel: Vertical, dry-stone masonry training walls about 12 feet high

*Based on the assumption that the surface area will not significantly increase with changes in reservoir elevation from 58.9 to 61.1.

(6) Downstream channel: Vertical, dry-stone masonry side walls 6 to 11 feet high. Width of channel narrows from 120 feet at dam to about 37 feet at 240 feet downstream.

(7) General: Whittendon Street Bridge crosses the discharge channel 365 feet downstream of the dam. Flow is through two 7-foot by 19.5-foot box culvert openings with inverts at El 46.0. Top of the street embankment is at about El 58.4.

j. Regulating Outlets. The regulating outlet is a 3-foot wide sluiceway through the spillway, located in the eighth bay from the east abutment. The invert of the sluiceway is at El 49.3. Flow is through a 3-foot by 4-foot opening controlled by a wooden sluice gate. A rack and pinion mechanism is mounted to the wooden framework over the spillway. The timbers are deteriorating, the mechanism is rusted, and the gate has not been operated since about 1970.

SECTION 2

ENGINEERING DATA

2.1 General. A drawing dated September 1935 is available from the Bristol County Commissioners Office and shows proposed repair of timbers on the dam (see Figure B-3). A report on hydraulic and stability analyses conducted for Mill River (Whittendon) Dam was prepared by Metcalf & Eddy, Inc. The report is dated June 1973 and copies are available from the Owner and from Metcalf & Eddy, Inc. No other plans, specifications, or computations are available from the Owner, State, or County agencies relative to the design, construction, or repair of this dam.

We acknowledge the assistance and cooperation of personnel from the Massachusetts Division of Waterways, the Massachusetts Department of Public Works, and Mr. David Olken of L&O Realty Trust.

2.2 Construction Records. The only construction records are the data referred to in Section 2.1. There are no as-built drawings for the dam.

2.3 Operating Records. No operating records are available, and there is no daily record kept of the elevation of the pool or amount of rainfall at the dam.

2.4 Evaluation

a. Availability. There is limited engineering data available.

b. Adequacy. The lack of detailed structural and construction data did not allow for a definitive review. Therefore, the evaluation of the adequacy of this dam is based on review of available reports and drawings, visual inspection, past performance history, and engineering judgment.

c. Validity. Comparison of the available drawings with the field survey conducted during the Phase I inspection indicates that the available information is valid.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The Phase I Inspection of the dam on Mill River was performed on November 30, 1978. A copy of the inspection checklist is in Appendix A. Previous inspections were conducted for the Bristol County Commissioners in August 1959 and July 1970. Copies of these reports are included in Appendix B. A report on the hydraulic and structural characteristics of the dam was prepared by Metcalf & Eddy, Inc. in 1973.

b. Dam. The dam consists of a spillway with vertical, dry-stone masonry abutments. The spillway is constructed of a rockfill base covered with unreinforced concrete on the crest and downstream slope. A timber walkway above the crest contains guideposts for 23 bays of abandoned slide gates, one bay containing a sluice gate and six bays of stoplogs.

The dam is in poor condition. Seepage at the toe could not be determined due to water flowing over the crest of the spillway. The most obvious deficiencies at the site are the deterioration of the timber walkway over the spillway and the inoperable condition of the 23 abandoned slide gates. The timbers in the walkway are rotting, and at least one timber is missing. The walkway, which provides access to the stoplogs, slide gates, and sluice gate, is only marginally safe to walk on. Due to the deterioration of the timber, some leakage was observed around the guideposts of some bays. Leakage is also occurring between some stoplogs and between the boards of some slide gates. There are no hooks, eye bolts, or other means of removing the stoplogs or boards of the slide gates. The concrete on the crest and downstream slope of the spillway is pitted and eroded. Also, stonework is missing from a section of the west training wall upstream of the dam.

c. Appurtenant Structures. A sluiceway located in the eighth bay from the east abutment serves as the outlet for the dam. Flow is through a 3-foot by 4-foot opening controlled by a wooden sluice gate. A rack and pinion mechanism is attached to the gate and mounted on the overhead walkway. The operating mechanism is rusty and the timbers where the mechanism is mounted are rotting. The slide gate has not been used for at least eight years, and may not be operable. Leakage is occurring from the guideposts on the sides of the slide gate.

d. Reservoir Area. The area around the impoundment of the dam is moderately developed with about 20 residences. There is also a complex of factories at the east abutment of the dam. It is possible that some future development could occur. The land is wooded or grassed, with slopes varying from 3 to 30 percent.

e. Downstream Channel. Discharge from the spillway enters a downstream channel which extends for about 365 feet to Whittendon Street. The channel has vertical dry-stone masonry side walls and a natural streambed. The width of the channel decreases from about 120 feet at the dam to 37 feet at about 240 feet downstream. Beneath Whittendon Street, the river flows through two 7-foot by 19.5-foot box culverts. Downstream, the river flows in a natural streambed.

Brush is growing along both sides of the downstream channel. Some brush is rooted into the tops of the side walls, and a few trees are overhanging the west side of the channel. Brush is also growing from the base of both side walls and partially out into the floor of the channel.

Stonework is missing from both side walls of the channel, and some sections of the west wall have partially collapsed. One section, about 60 feet downstream of the dam on the west wall, has completely collapsed.

There is no significant amount of debris in the floor of the downstream channel.

3.2 Evaluation. The above findings indicate that the dam is in poor condition and that there are several deficiencies which require attention. It is evident that the dam is not maintained. Recommended measures to improve these conditions are stated in Section 7.3.

SECTION 4

OPERATING PROCEDURES

4.1 Procedures. There are no operating procedures at this dam. The sluice gate has not been operated for at least eight years, and there is no means for removing the stoplogs or for operating the abandoned slide gates. The water level in the pond can only be controlled by operating gates at Morey's Bridge Dam, located about 1 mile upstream.

4.2 Maintenance of Dam. The dam is not maintained. The timber walkway over the spillway has deteriorated such that it is unsafe to walk on, and leakage is occurring around the guideposts. Leakage is also occurring between the stoplogs and between boards of the abandoned slide gates. Stonework is also collapsing from the west training wall upstream of the dam.

4.3 Maintenance of Operating Facilities. The sluice gate which controls the only outlet for the dam is in poor condition and may not be operable. The stone side walls of the downstream channel are overgrown with brush. Some stones are missing from the walls, and sections of the west side wall are collapsing.

4.4 Description of Any Warning System in Effect. There is no warning system in effect at this dam. However, the offices of the Owner, L&O Realty Trust, are located in the mill complex near the right abutment of the dam.

4.5 Evaluation. There is no regular program of inspections or maintenance or any warning system in effect at Mill River Dam. This is extremely undesirable considering the dam is in the "high" hazard category. A program of inspection and maintenance and a surveillance system for this dam should be implemented as recommended in Section 7.3.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. Mill River Dam is a run-of-river type structure with a total drainage area of 41.4 square miles. The drainage area is mostly rural with localized moderate development. There are 12 control structures, mostly dams, located upstream on three main tributaries (see Figure D-1). Mill River Dam is a 120-foot long, ungated spillway and the pond level is controlled by operation of a gated outlet located about 1 mile upstream at Morey's Bridge Dam.

The maximum storage in Mill River Pond is calculated to be 160 acre-feet. At the time of the inspection, the pond was at El 59.4 and water was discharging through the western 21 bays on the spillway.

In March, 1968, a flood occurred, causing Mill River Pond to rise to El 61.4. Upstream at Morey's Bridge Dam, the water level in Lake Sabbatia rose to El 65.6, causing flooding of homes and roads around the lake, and piping of a portion of the embankment. A subsequent study of the hydraulics and stability of both dams concluded that the discharge capacity at Morey's Bridge Dam needed to be increased. As a result, a spillway would also be needed to increase the discharge capacity at Mill River (Whittendon) Dam. An important hydraulic factor is the low head differential (about 2 feet) between the two dams. The Owner has not implemented any of the recommendations in the report. Instead, the slide gates at Mill River Dam were abandoned, their operating mechanisms removed, and the tops cut off. In its present condition, Mill River Dam is used as an overflow weir, with the water level controlled upstream.

b. Design Data. There are no hydraulic/hydrologic computations available for the design of the

spillway at Mill River Dam. Hydraulic analyses in the 1973 study, based on the Kinnison-Colby rare flood, used a peak flood inflow of 1,800 cfs at Mill River Dam. With all the slide gates open, the stoplogs removed, and the sluice gate half open, this flood produced a pond level at El 59.9.

c. Experience Data. A previous inspection report (see page B-5) states that during the 1955 flood, 1 foot of water was in the cellar of Whittendon Manufacturing Co., located near the east abutment of the dam. It also states that in June, 1967, there was "no pond" and the dam was "lowered". The engineering report dated 1973 states that the maximum pond level was at El 61.4 during the March 1968 storm.

d. Visual Observations. Water discharges over stoplogs, abandoned slide gates and the sluice gate located in 30 bays on the crest of the spillway. The effective length of the weir is 91 feet, with 21 bays at El 58.9 and nine bays at El 59.6. Water flows over the downstream face of the dam, which slopes at 1:1 to 2:1 and is covered with concrete. Large blocks of rock located at the toe prevent erosion. The channel below the spillway extends 365 feet downstream to Whittendon Street. The channel is 120 feet wide at the spillway and decreases to about 37 feet wide at 240 feet downstream. The vertical side walls are 6 to 11 feet high, and the floor slopes at about 1 percent. About 365 feet downstream, water flows beneath Whittendon Street in two 7-foot by 19.5-foot box culverts with inverts at El 46.0. Below Whittendon Street, water flows in a natural stream bed.

Timbers are deteriorating in the walkway and in the guideposts forming bays on the crest of the spillway. This structure could collapse during a heavy storm. The walkway provides access to the only outlet at the dam, which is a sluice gate. The operating mechanism on the sluice gate is in poor condition and may not be operable. A more detailed discussion of the condition of the dam and appurtenances is presented in Section 3, Visual Inspection.

e. Test Flood Analysis. Based on the Corps of Engineers' guidelines, Mill River Dam has been placed in the "small" size category and the "high" hazard category. Accordingly, a test flood equal to one-half the probable maximum flood (PMF) was used for this analysis.

The test flood inflow for Mill River Dam was estimated to be equal to the test flood outflow from Morey's Bridge Dam. This is due to the delayed effect of the flood from Morey's Bridge Dam, the relatively small drainage area between the dams, and the minor storage available behind Mill River Dam. Because of the flat, swampy character of the watershed, the PMF rate for Morey's Bridge Dam was determined to be 250 cfs per square mile. This calculation is based on the average slope of the drainage area of 0.3 percent, the pond-plus-swamp area to drainage area ratio of 17 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum Probable Flood Peak Rates (dated December, 1977). Applying one-half the PMF to the 41.2 square miles of drainage area upstream of Morey's Bridge Dam, results in a calculated peak flood flow of 5,150 cfs as the test flood inflow. By adjusting the test flood inflow for surcharge storage, the maximum discharge rate was established as 2,460 cfs (60 cfs per square mile) with a water surface at El 69.1. The test flood inflow of 2,460 cfs for Mill River Dam is estimated to be equal to the test flood outflow because of negligible storage behind that dam. The test flood outflow of 2,460 cfs (59 cfs per square mile) will result in a pond level at El 63.1.

Hydraulic analyses indicate that the spillway (with all gates closed and stoplogs in place) can discharge a maximum of 660 cfs with the pond at El 61.1, which is the low point on the east abutment of the dam. This discharge is 27 percent of the test flood outflow. Discharge over the abutments is estimated to be 320 cfs with a maximum head of 2.0 feet. The depth at critical flow would be 1.3 feet with a velocity of 6.1 feet per second. The low level outlet can discharge 148 cfs with the pond at El 58.9 (top of slide gates). The low

level outlet can lower the pond by 1 foot, starting from the top of the slide gates, in about two hours.

If all the gates were opened and the stoplogs removed by the time the pond reached El 59.5, the spillway could discharge 2,640 cfs at El 60.8 which is 0.3 feet below the east abutment of the spillway. At the present time, the gates cannot be opened.

f. Dam Failure Analysis. The peak discharge rate due to failure was calculated to be 4,460 cfs for a 48-foot long section of the spillway. Failure would raise the depth of water at the Whittendon Street Bridge to 14 feet (El 60.0). This would produce flooding of buildings adjacent to the east wall of the downstream channel, and a 1.6-foot high flow over Whittendon Street (see flood impact area shown on Location Map). The bridge embankment would limit the effect of the flood wave farther downstream, although flow through the two 7-foot by 19.5- foot culverts would produce some downstream flooding of thickly developed areas. For this reason, the dam has been placed in the "high" hazard category.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The evaluation of the structural stability of Mill River Dam is based on a review of the report dated 1973 on reconstruction of Mill River (Whittendon) Dam, a review of previous inspection reports, and the visual inspection conducted on November 30, 1978.

As discussed in Section 3, Visual Inspection, the dam is in poor condition. The presence of seepage could not be clearly determined, however, a previous inspection report dated 1970 states that several severe leaks were observed at the toe of the dam (see page B-3 in Appendix B). Deterioration of the timber walkway over the spillway is making the access walkway unsafe, causing leaking around the stoplogs and slide gates, and is contributing to the poor condition of the sluice gate.

b. Design and Construction Data. The dam was originally constructed in 1832, reconstructed in 1882, and reconstructed or repaired again about 1935. The only available data on construction of the dam are presented on a drawing dated 1935 (Figure B-3) and in the report dated 1973, mentioned above. The report includes logs of two borings taken at each abutment of the dam and presents hydraulic and structural analyses of the structure. No other plans, specifications, or computations are available from the Owner, State, or County offices relative to the design and construction of this dam.

Boring logs taken at the site show that the dam is founded on decomposed shale overlying metamorphosed sandstone and shale. A stability analysis discussed in the 1973 report concluded that the flood stage in Mill Pond should be maintained below El 60.5 to insure stability of the dam against sliding.

c. Operating Records. There is no instrumentation of any type in the embankment at Mill River Dam, and no instrumentation was ever installed at this site. The performance of the embankment under prior loading can only be inferred by physical evidence at the site. A previous inspection report (see page B-4 in Appendix B) notes that in July, 1967, the dam was "lowered" and the pond was drained.

d. Post-Construction Changes. The Owner reports that the dam was "reconstructed" about 40 years ago, however, this was before L&O Realty's ownership. There is a drawing dated 1935 (Figure B-3) indicating proposed replacement of some timbers.

Post-construction changes were performed by the Owner in 1969-1970, after a flood in 1968. These included removal of the operating mechanisms from most of the slide gates, removal of the upper portions of the slide gates and sluice gate to allow discharge over the tops, and placing of unreinforced concrete on the crest and downstream slope of the rockfill base.

There are no as-built drawings available for the dam and no other records of post-construction changes.

e. Seismic Stability. The dam is located in Seismic Zone No. 2, and in accordance with Phase I "Recommended Guidelines" does not warrant seismic analysis at this time.

SECTION 7

ASSESSMENT, RECOMMENDATIONS,
AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Based upon a review of available reports and drawings, the visual inspection of the site, and limited operational or maintenance information, there are deficiencies which must be corrected to assure the continued performance of this dam. Generally, the dam is considered to be in poor condition. However, several signs of distress were observed at the site: 23 inoperable slide gates, deterioration of timbers in the walkway on the crest of the spillway, leakage around and between stoplogs and gates on the crest of the spillway, poor condition of the operating mechanism for the sluice gate, overgrowth of brush on both walls of the downstream channel, and collapsing stonework on walls of the downstream channel and on the west training wall upstream of the dam.

Hydraulic analyses indicate that the spillway (with all gates closed and stoplogs in place) can discharge an estimated flow of 660 cfs with the pond at El 61.1, which is the low point on the abutment of the spillway. An outflow test flood (one-half PMF) of 2,460 cfs results in a pond at El 63.1 and will overtop the dam by 2.0 feet. The spillway can discharge 27 percent of the test flood before the dam is overtopped. If all the gates were opened and all stoplogs removed by the time the pond level reached El 59.5, the spillway could discharge 2,460 cfs with the pond at El 60.8, which is 0.3 feet below the east abutment of the spillway. At the present time, the gates cannot be opened.

b. Adequacy. The lack of detailed design and construction data did not allow for a definitive review. However, a detailed hydraulic report by Metcalf & Eddy, Inc. dated June 13, 1973, was available. Therefore, the evaluation of the adequacy of this dam is based on a review

of the June 13, 1973 report, visual inspection, past performance and engineering judgment.

c. Urgency. The recommendations and remedial measures outlined below should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.

d. Need for Additional Investigation. Additional investigations to further assess the adequacy of the dam are outlined below in Section 7.2, Recommendations.

7.2 Recommendations. The spillway discharge capacity is not considered adequate. Therefore, further hydrologic and hydraulic studies are required to determine what alternative measures are necessary to significantly increase the discharge capabilities at the dam and reduce the overtopping potential. In view of the concerns over the continued performance of the dam, it is recommended that the Owner employ a qualified consultant to conduct these additional hydraulic/hydrologic studies, including an evaluation of the recommendations outlined in the report by Metcalf & Eddy, Inc. dated June 13, 1973.

Recommendations on repairs and maintenance procedures are outlined below under Section 7.3, Remedial Measures.

7.3 Remedial Measures

a. Operating and Maintenance Procedures. The dam and appurtenant structures are not maintained. It is recommended that the Owner accomplish the following:

(1) immediately remove all of the abandoned slide gates from the spillway and lower the pond to El 55.1. The pond should be maintained at this level until the recommendations and following remedial measures are implemented.

(2) restore the abandoned slide gates to operating condition. At the present time, only two of the slide gates have stems, and none have operating mechanisms.

(3) restore deteriorating timbers in the walkway structure over the spillway,

(4) restore the sluice gate to operating condition,

(5) remove brush and small trees growing on both sides of the downstream channel,

(6) repair stonework on both walls of the downstream channel and on the west wall upstream of the dam,

(7) implement a systematic program of maintenance inspections. As a minimum, the inspection program should consist of a monthly inspection of the dam and appurtenances, supplemented by additional inspections during and after severe storms. All repairs and maintenance should be undertaken in accordance with all applicable State regulations.

(8) periodic technical inspections of this dam should be continued on an annual basis,

(9) institute a definite plan for surveillance and a warning system during periods of unusually heavy rains and/or runoff.

7.4 Alternatives. An alternative to implementing the recommendations and remedial measures listed above would be to drain the pond and remove the entire dam.

APPENDIX A

PERIODIC INSPECTION CHECKLIST

MILL RIVER DAM

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT MILL RIVER

DATE NOV 30 1978

TIME 12.00 - 4:00 PM

WEATHER PARTLY SUNNY

W.S. ELEV. 59.4* U.S. 48.6* D.S.

*based on assumed benchmark at El 61.09 on east abutment of dam

PARTY:

1. R. WEBER
2. C. SWEET
3. H. LORD
4. W. CHECCHI
5. D. COLE
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	DAM	R WEBER / C SWEET	
2.	SPILLWAY		
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST

PROJECT Mill River Dam DATE Nov 30 1978

PROJECT FEATURE Spillway NAME R. Weber

DISCIPLINE Geotechnical NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Fair To Poor, some debris and leaves in channel
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	few small trees
Floor of Approach Channel	submerged
b. Weir and Training Walls	
General Condition of Concrete	dry stone masonry; missing in places good condition in others (see below)*
Rust or Staining	None
Spalling	None
Any Visible Reinforcing	None
Any Seepage or Efflorescence	Minor seepage through walls in some areas
Drain Holes	None
c. Discharge Channel	
General Condition	fair
Loose Rock Overhanging Channel	none
Trees Overhanging Channel	brush and trees up to 6 inches
Floor of Channel	Large boulders near spillway toe
Other Obstructions	None, training wall lines channel

* water discharging over spillway during inspection concrete spillway pitted and eroded, flash boards leaking, operating structures missing or apparently marginally operable, apparent leak beneath spillway

PERIODIC INSPECTION CHECK LIST

PROJECT Mill River Dam DATE Nov 30 1978

PROJECT FEATURE Spillway NAME R. Weber

DISCIPLINE Geotechnical NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	WOODEN STRUCTURE ROTTED AND IN VERY POOR CONDITION
Bearings	-
Anchor Bolts	-
Bridge Seat	-
Longitudinal Members	TIMBER
Under Side of Deck	fair TO POOR
Secondary Bracing	POOR
Deck	Timber fair TO POOR
Drainage System	NONE
Railings	Timber POOR
Expansion Joints	NONE
Paint	NONE
b. Abutment and Piers	
General Condition of Concrete	Timber PIERS VERY POOR CONDITION
Alignment of Abutment	good
Approach to Bridge	blocked AT ONE END OPEN TO PUBLIC AT OTHER
Condition of Seat and Backwall	fair

PERIODIC INSPECTION CHECK LIST

PROJECT Mill River DATE Nov 30 1978

PROJECT FEATURE Spillway NAME R. Weber

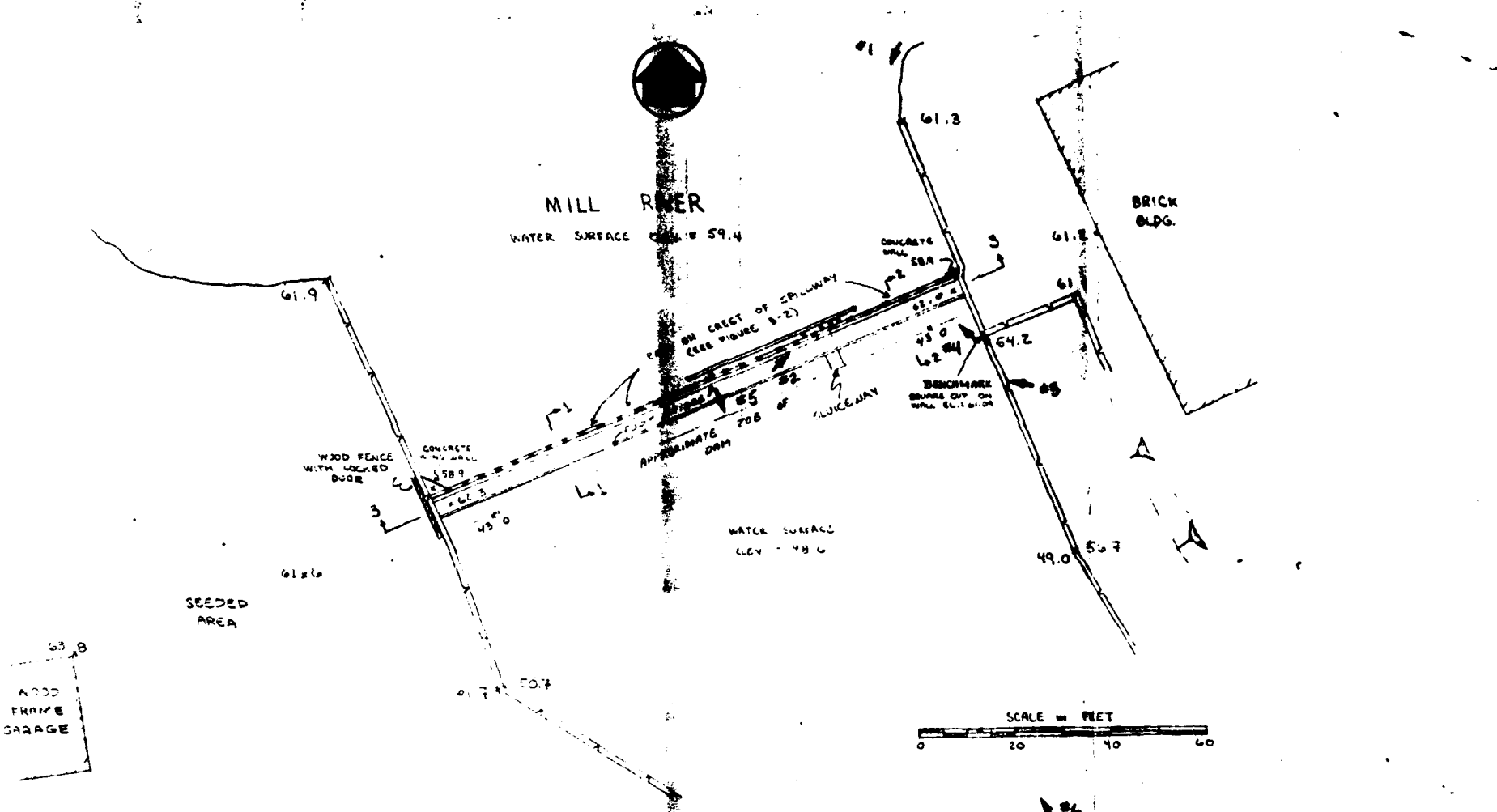
DISCIPLINE Geotechnical NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	Poor, sluice gate appears inoperable *
Rust or Staining	none
Spalling	none
Erosion or Cavitation	heavy erosion of concrete
Visible Reinforcing	none
Any Seepage or Efflorescence	at gate
Condition at Joints	UNKnown
Drain Holes	UNKnown
Channel	
Loose Rock or Trees Overhanging Channel	NONE
Condition of Discharge Channel	FAIR SAME AS SPILLWAY

* WOOD PLANKS LINE SLUICEWAY

APPENDIX B

PLAN OF DAMS AND PREVIOUS
INSPECTION REPORTS



NOTES

1. ELEVATIONS SHOWN ARE REFERENCED TO TEMPORARY BENCHMARK ELEV 61.09 (MSL) AS SHOWN ON FEBRUARY 1978 PLAN (FIGURE 3 WHITTENTON DAM PROPOSED MODIFICATIONS) by METCALF & EDDY INC
2. INFORMATION SHOWN PASSED ON FIELD SURVEY OF NOVEMBER 30 1978 AND REFERENCED PLAN
3. A2 INDICATES LOCATION AND DIRECTION OF VIEW FOR PHOTOGRAPHS
4. SEE FIGURE B-2 FOR SECTIONS THROUGH DAM AND ELEVATION VIEW OF CREST OF DAM

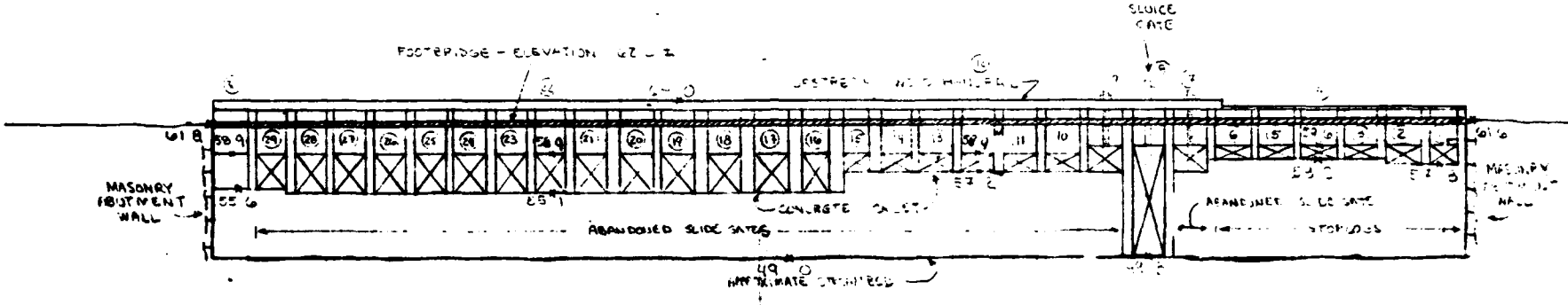
METCALF & EDDY INC.

NATIONAL PROGRAM OF INSPECTION OF DAMS

MILL RIVER DAM

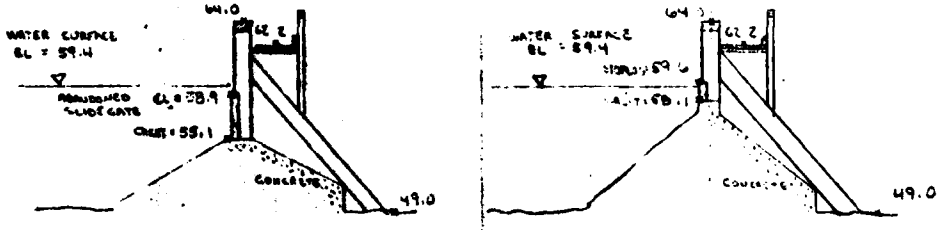
FIGURE B-1 PLAN OF DAM

SCALE 1" = 20'



SECTION B-B
ELEVATION VIEW

NOTE:
(11) INDICATES BAY NUMBER

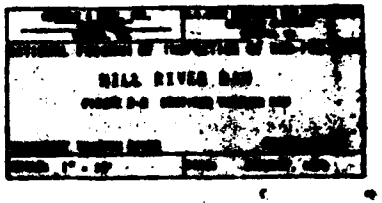


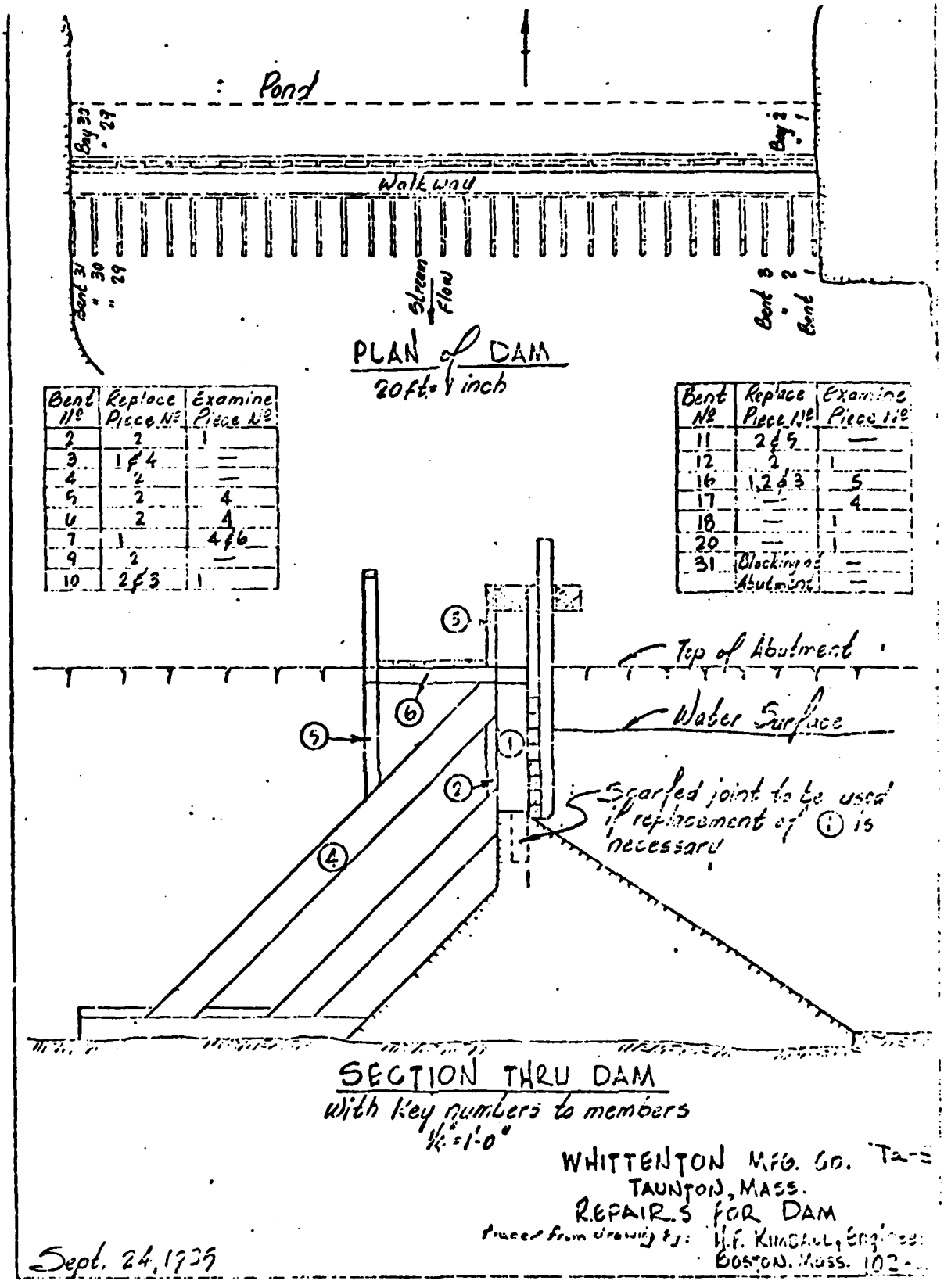
SECTION 1-1

SECTION 2-2

SCALE IN FEET
0 10 20 30 40 50

METCALF & EDDY, INC.





Bent No	Replace Piece No	Examine Piece No
2	2	1
3	1 & 4	—
4	2	—
5	2	4
6	2	4
7	1	4 & 6
9	2	—
10	2 & 3	1

Bent No	Replace Piece No	Examine Piece No
11	2 & 5	—
12	2	1
16	1, 2 & 3	5
17	—	4
18	—	1
20	—	1
31	Blocking of Abutment	—

FIGURE B-3

MILL RIVER DAM

BRISTOL COUNTY, MASS.
INSPECTION REPORT FOR DAMS

PREPARED FOR THE BRISTOL COUNTY COMMISSIONERS
BY UNIVERSAL ENGINEERING CORP., BOSTON, MASS.

DAM NO. Ta-5
TOWN Taunton

INSPECTION DATE	REMARKS & RECOMMENDATIONS
7-23-70	The level of the pond behind the dam is high and there is a moderate flow over the crest. There are presently no stop logs in place, and all 30 sluice gates leak. Two of the three flood gates appear to be sealed off with concrete and there is severe leaking through, around and under the one remaining gate. The timber on all three flood gates is rotted and they are unoperative. There is considerable undermining as evidenced by the several severe leaks at the toe of the dam. The general condition of the dam is poor. The sluice intake located east and upstream of the dam has been abandoned and the inlet channel has been filled in. In order to be effective as a flood control dam, the structure requires complete reconstruction, including the construction of an adequate sluice and gate system for flood flows, and should be properly operated through the sluiceway.

Supplement to original report and data by Meyder, Harding & Buchanan, Inc. DAM NO Ta-5

6-3-293-5

BRISTOL COUNTY, MASS.

INSPECTION REPORT & DATA FOR DAMS

PREPARED FOR THE BRISTOL COUNTY COMMISSIONERS
BY HAYDEN, HARDING & BUCHANAN, INC., BOSTON, MASS.

Dam No. Ta-5
Town: Taunton
Stream: Mill River
Pond:
Date: 8-11-59
By: AAV - RMB

Owner: Whittenton Mfg. Co.
His Address: (Olken)
Function of Dam: ** 750,000,000 gallons annually for
Location & Access: Whittenton Street

CONDITION RATING
Structural:
Hydraulic:
General: Fair
PRIORITY: 1

USGS Quad. Taunton Lat. 41°53'25" Long. 71°06'25"

Drainage Area: 43.7 sq.mi.; Ponds: ac.; Res.Cdam: ac.
Character of D.A.: 1.5 sm water surface, 1.5 s.m.

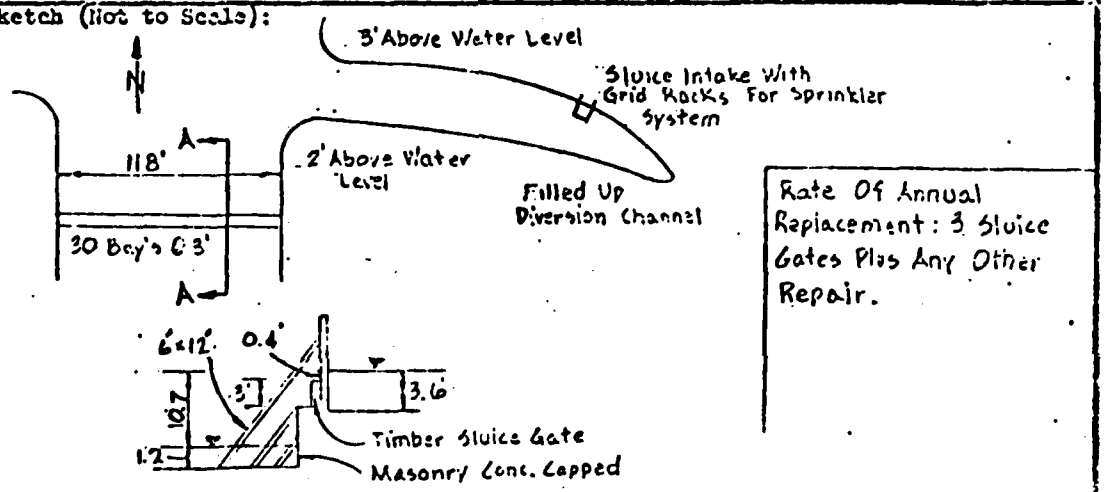
Estimated Discharge Capacity: Sprinkler system: 2000 gpm with elec. pump & 2000 gpm with steam pumps. Sluiceways Q = 3800 c.f.s. minimum (freeboard)

KIRKISON-COLBY FLOODS
Minor: 875 cfs
Major: 1750 cfs
Rare: 2770 cfs
Maximum: 11,550 cfs

General Description of Dam and Discharge Control: (Originally constructed in 1832)

Buttress dam with 30 manual sluice gates inclusive of one flood gate which reportedly can drain the reservoir in one day, if flow is shut off at the Moreys Bridge Dam.

Sketch (Not to Scale):



Rate Of Annual Replacement: 3 Sluice Gates Plus Any Other Repair.

Remarks and Recommendations: Should be examined structurally and hydraulically. Gates appear okay, but timber supporting lower portion of dam could not be appraised. It is reported to be in good condition. Overflow capacity may be adequate but should be checked since not more than 2 feet freeboard is available. Recommend opening sluice gates to lower pond level and reduce pressure on dam. Flooding of 1 foot in cellar during 1955 flood. The Whittenton Mfg. Co. owns all water rights above this dam.

* Change Priority to 1 4-1-63

Re-Inspection

Date	By	Comment
10-30-61	AAV	Same condition.
7-8-67	WHL	No Pond. Dam Lowered.
3-20-68	WHL	See memo 4-1-68

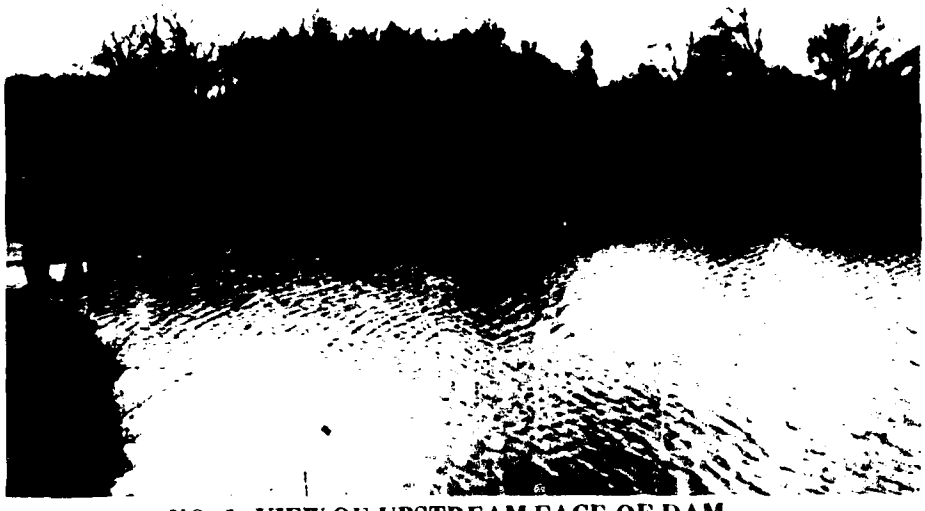
Dam No. Ta-5

** cloth finishing. Water is not polluted but is treated. Also used for fire protection for plant and to city in emergency.

MILL RIVER DAM

APPENDIX C

PHOTOGRAPHS

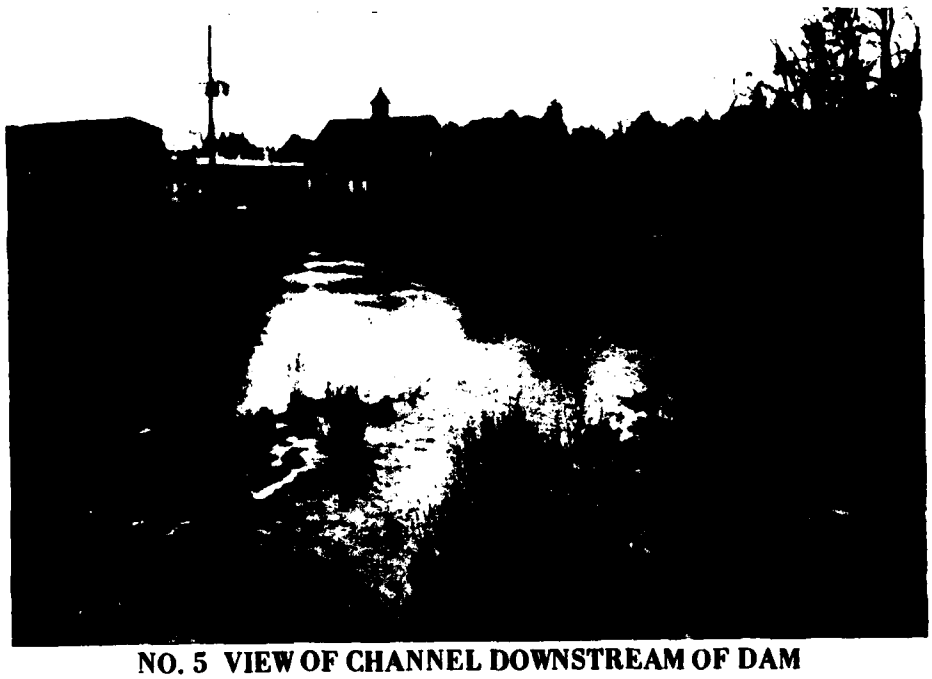


NO. 1 VIEW OF UPSTREAM FACE OF DAM

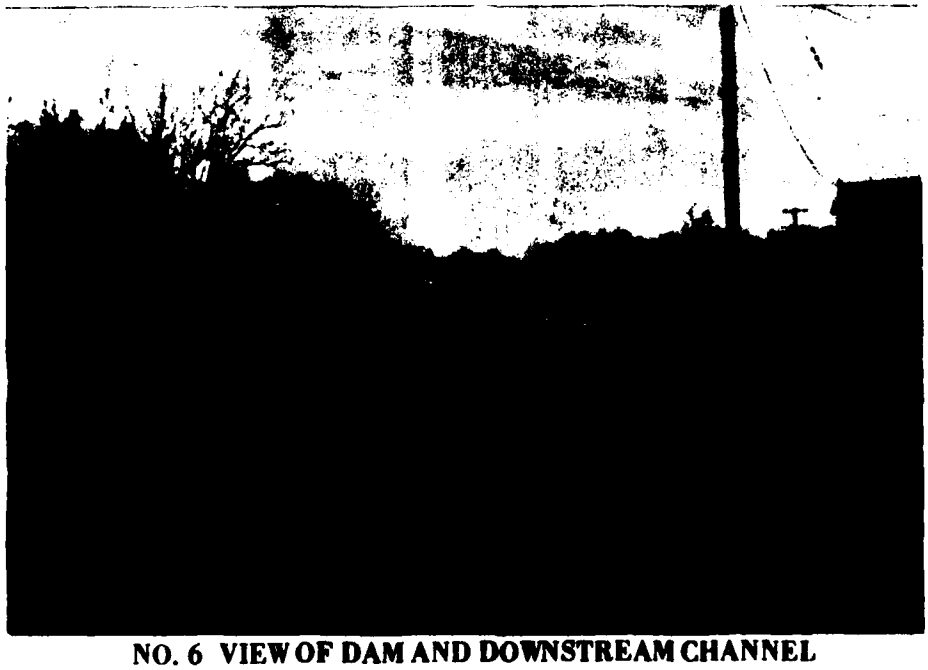
NO. 2 VIEW OF OPERATING MECHANISMS FOR SLIDE GATES

NO. 3 VIEW OF DOWNSTREAM FACE OF DAM

NO. 4 DETAIL OF DOWNSTREAM FACE OF DAM



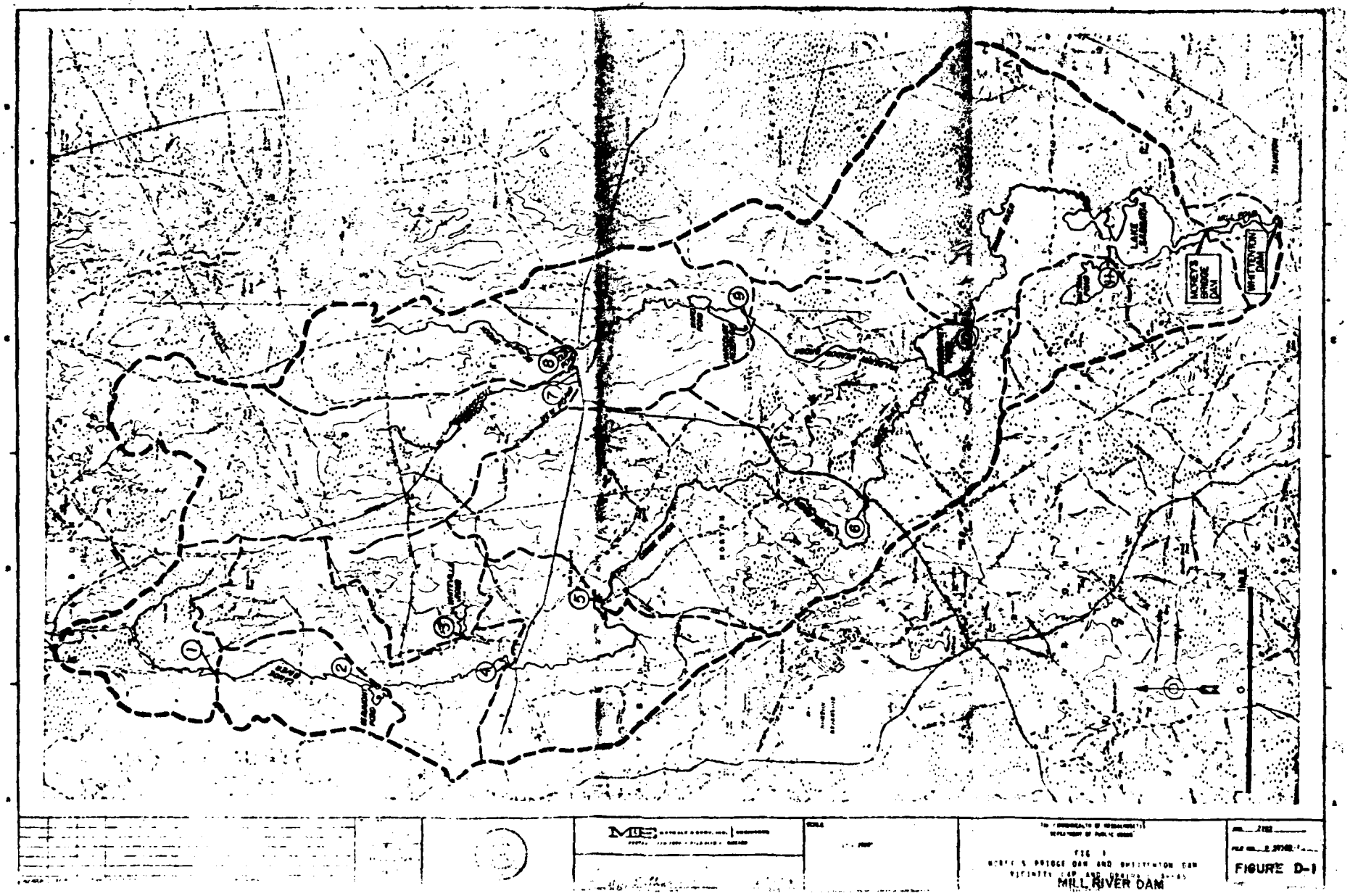
NO. 5 VIEW OF CHANNEL DOWNSTREAM OF DAM



NO. 6 VIEW OF DAM AND DOWNSTREAM CHANNEL FROM WHITTENTON STREET

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



Project Nat. Review of Non Fed. Dams Acct No. 6191 Page 1 of 9
Subject Bristol County, Mass. Compld By LEB Date 2/7/79
Detail MILL RIVER DAM Ck'd By MB Date 2/15/79

(I) Test Flood & Storage Function - LAKE SABBATIA

1- Total Drainage Area - 41.2 mi²

2- Pond(s) Area: 1.272
Swamp(s) Area: 5.618
Total Area Pond(s) & Swamp(s): 6.890

% Pond & Swamps = $\frac{6.890}{41.2}$ = 16.7%

3- $\frac{350 - 62}{77700} = 0.0037$ } Say Ave Slope = 0.4%

4- Using C. of E. Curves for Peak Flow Rates & above guide values the Peak Flow Rate was estimated to be well below "Flat and Coastal" and taken at 250 c.f.s./mi²
Size Class: ; Hazard Pot.: ; Spill. Des. Flood:
Use: Test Flood = ½ PMF - Based on Mill River Dam Criteria

5- Test Flood Inflow = ½(250) 41.2 = 5150 c.f.s.

6- Pond Storage - see Sheet 2
The pond area is sq mi at elev.
Based on a const. area, storage increases at ac. feet per foot of depth increase

7- Spillway crest elev. is

8- Storage Functions are based on $Q_{out} = Q_{in}\left[1 - \frac{S_{out}}{R}\right]$
S_{out} = Storage Vol. in Reservoir related to final Q_{out} in terms of inches of rain over the drainage area.

S (in Inches) = 12 D ( ) = ; D; R = 6hr rain of storm
D = Storage depth in feet above spillway crest in reservoir

9- Storage Functions: (Test Flood & ½ PMF - if needed)

F_{TF}	= 5150 - 542 S	=	-	D
$F_{½PMF}$	= -	S	= -	D

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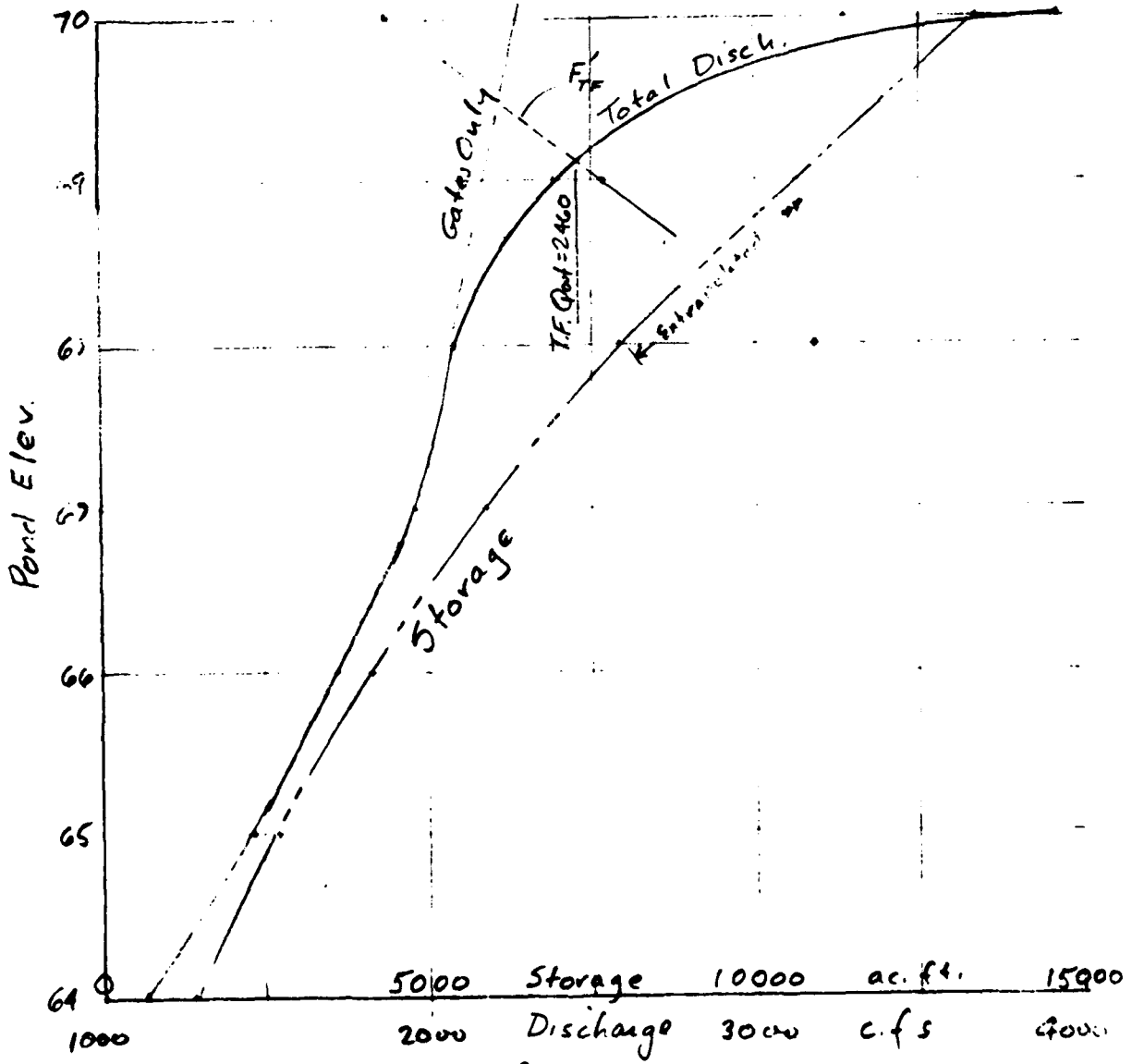
(II) Lake Sabbatia Discharge

Disch.-Storage Ratings from: Rept to Mass. D.P.W. on ... Dams - Taunton Mass. June 1972

Pond El	64	65	66	67	68	69	70	
Disch	1130	1460	1720	1960	2080	(2400)	(3900)	Extrapolated
Stor.-ac.ft	1340	2658	4088	5847	7936	(10600)	(13300)	Extrapolated
Stor.-S'	0.61	1.21	1.86	2.66	3.61	4.82	6.05	
5425	331	656	1008	1442	1959	2612	3279	
5150-5425'	4819	4494	4142	3708	3193	2538	1870	$= F'_{TF}$



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III Discharge Ratings

A - Spillway

The spillway [illegible] the crests of 90 stoplogs at various elevations

Width: 120' - 3'(12"-timbers) = 91.0 ft

Width of Each stoplog ditch: $\frac{91}{30}$ = 3.03 ft per bay

Contraction allowance: (2 cont.)(0.1) 2' = 0.4' [Ave Hd ≈ 2']

Crest Elevations: 9 bays @ elev 59.59 ± ≈ 59.6 ± [illegible]
12 bays @ elev. 59.2 ± [illegible]
9 bays @ elev. 58.96 ± ≈ 59.0 ± [illegible]

Use Williams & Hazen "Hydraulic Tables" w/ C_d = 2.0 & L = 2.6 each bay

Pond Elev	59.5	60.0	60.5	61.0	62.0	63.0	64.0	65.0
Q_1	40	90	160	230	420	640	890	1140
Q_2	20	70	150	250	480	760	1080	1440
Q_3	—	20	70	130	280	480	710	970
ΣQ_s	60	180	380	610	1180	1880	2680	3550

B - Crest Flow

Broad Crest Weir - say $q = 2.55 H_e^{1.5}$
[Ref.: V.T. Chow "Open Chan. Hydr." pg 52]

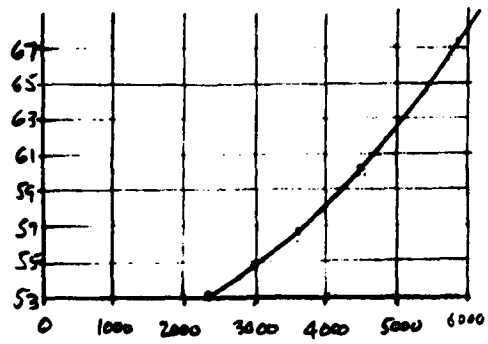
Pond El.	62	63	64	65	66
30' @ 61	80	220	400	610	
40' @ 62	—	100	290	530	
40' @ 63	—	—	100	290	
ΣQ_c	80	320	790	1430	

(III) Discharge Ratings - Cont.

C - Whittenton St. Bridge

Bridge opening constricted by beam under roadway
Clear opening: 2 @ 7.1' Hi by 19.5' Wide
Assume Ent. Control. Ref: V.T. Chow "Open Chan. Hyds." pg 498
Inv. El. 45.9

H/d	1.0	1.25	1.5	2	3
q	60	77	92	115	150
Q_B	2340	3000	3590	4490	5850
El. Water	53.0	54.8	56.6	60.1	67.2
Depth	7.1	8.9	10.7	14.2	21.3



D - Dam to Bridge Channel

Min. Width - 37'; Rect. $\therefore R \approx y$; $S_o = \frac{47.9 - 45.9}{220} = .0086$, $\sqrt{S_o} = .0929$

$n \approx 0.04 \therefore V = 3.462\, y^{2/3}$

y	5	10	15
A	185	370	555
V	10.1	16.1	21.1
Q	1870	5950	11700
El. Water @ Bridge	50.9	55.9	60.9

By Insp., Bridge "Controls" upstr. levels, not channel (see "C")

E - Flow over Whittenton St.

Broad crest weir flow - say, $q = 2.55\, H_w^{1.5}$
[Ref. V.T. Chow, "Open Chan. Hyds." pg 52]

Water El.	59	60	61	62	63
40' @ 58.2	70	250	480	760	1070
10' @ 60.6	—	—	10	40	90
10' @ 61.6	—	—	—	10	40
70' @ 62	—	—	—	—	180
ΣQ_w	70	250	490	810	1380
Add Q_B	4250	4480	4700	4850	5100
Total	4320	4730	5190	5660	6480

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(III) Discharge Ratings - Cont.

F- Spillway Flow w/ Stoplogs Removed

Ave. Hydr. width of each bay = 2.6' - after contraction - see "A"

Use W. & H. "Hydr. Tables" - w/ $y = 30$ & Shape Coef. = 0.95

Conc. Crest Elevations:
- 13 bays @ el. 55.1
- 1 bay @ el. 55.6
- } Say 14 @ 55.1 for Q_1

Note: Bay w/ Low Level Gate would have notch crest flow if gate is raised
- 8 bays @ el. 57.2
- 2 bays @ el. 57.8
- } Say 10 @ 57.3 for Q_2
- 4 bays @ el. 58.2
- 1 bay @ el. 58.9
- } Say 5 @ 58.3 for Q_3

Pond El.	57	58	59	60	61	62
Q_1	300	560	880	1240	1640	2050
Q_2	—	70	180	360	580	830
Q_3	—	—	80	90	180	290
ΣQ_F	300	630	1090	1690	2400	3170
Add Q_L	140	140	150	160	170	170
Add Q_C	—	—	—	—	—	80
Tot. Q	440	770	1240	1850	2570	3420

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(III) Discharge Relations - cont.

G- Low Level Outlet

Sluice Gate - 3' wide x 3.9' max ht., Inv. El. 49.33 - Say 49.3
Assume Pond El. = 59.0

Ref.: V.T. Chow, "Open Chan. Hydr." pg 508, 509

$Q_L = C L h \sqrt{2g y_1}$; Free Disch.: $C = 0.52$; $\frac{y_1}{h} = \frac{9.7}{3.9} = 2.5$

$Q_L = 0.52(3)3.9\sqrt{64.4(9.7)} = 152$ cfs. } Ave 148 cfs

W/ Pond @ El. 58.0, $Q_L' = 144$ cfs }

Time to lower Pond 1 foot = $\frac{23.4(43560)}{148(3600)} = \pm 1.9$ hours

Use in "F:- $Q_L = 48.8\sqrt{y_1}$; y_1 = Pond El. - El. 49.3

(IV) Abutment Discharge

T.F. Outflow Pond El. : 63.1
L.P. Abutment 61.1
2.0 Head.

$q_A = 2.55(2.0)^{1.5} = 7.2$ cfs/ft.

As Critical Flow: y_c 1.2 ft.
$V_c = 6.1$ fps

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(V) Mill River Dam Pond

Size: Small ; Hazard: High ; Test Flood : ½ PMF

Peak inflow from Lake Sabbatia is 2460 c.f.s. for test flood conditions.

Incremental tributary area between Lake Sabbatia and Mill River Dam is ± 0.2 mi².

Peak flow from incremental area should occur a number of hours before the peak flow from Lake Sabbatia.

Storage behind Mill River Dam is minimal.

∴ Omit storage reduction & added flow from incremental area. Assume Test Flood outflow at Mill River Dam ≃ Outflow from Lake Sabbatia which equals 2460 c.f.s.

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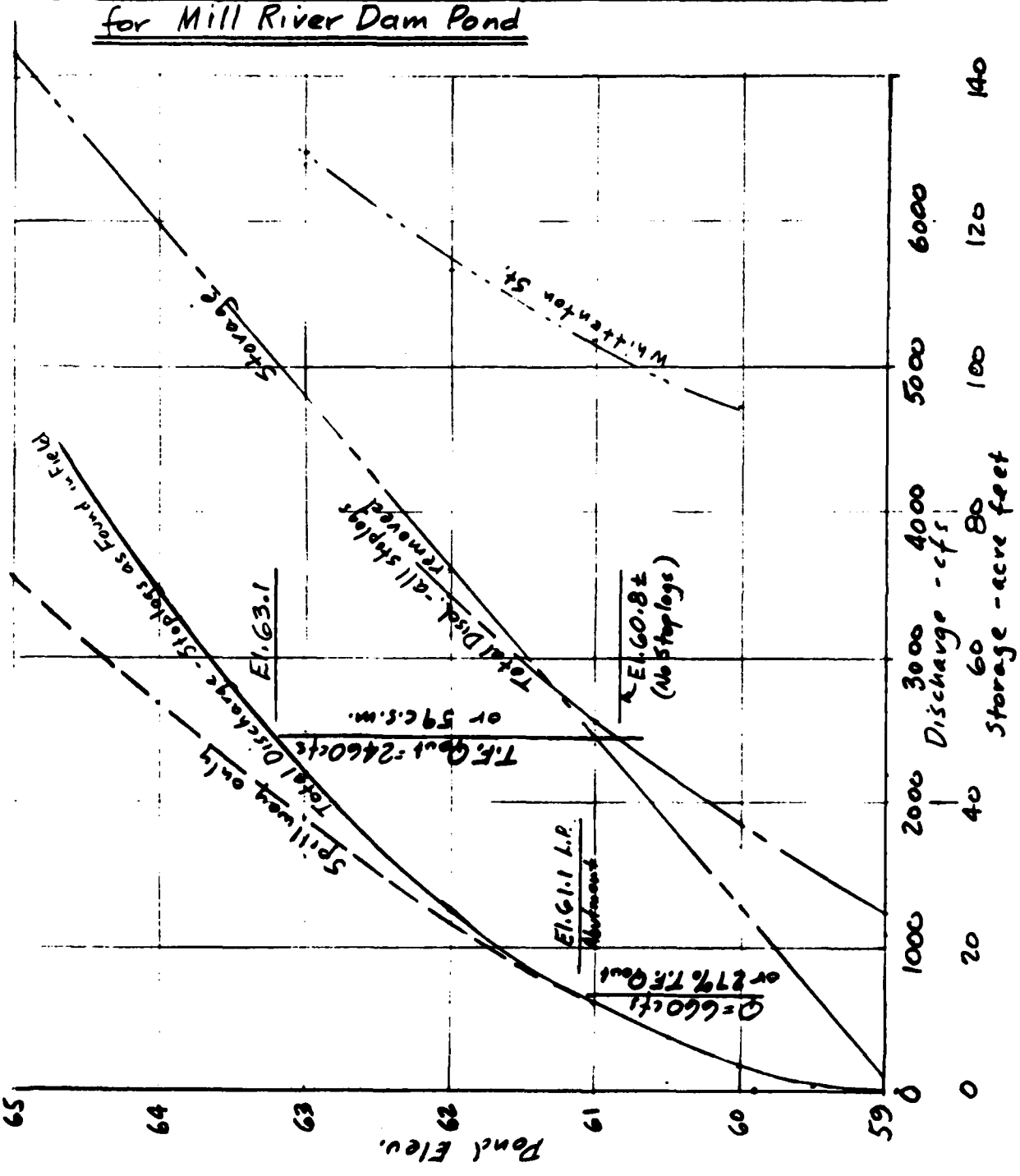
(VI) Discharge, Storage & Storage Function vs Pond Elev. for Mill River Dam Pond



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(VIII) Failure of Dam

Peak Failure Flow:

Pond Elevation - 61± Top of Side Wall
Toe Elevation — 48±
$Y_o = 13±$
Dam Length Subject to Breaching = 120'
$W_o = 40\%(120) = 48$

$$Q_{P_1} = 1.68\, W_o (Y_o)^{1.5} = 1.68(48)(13)^{1.5} = 3800 \text{ cfs.}$$

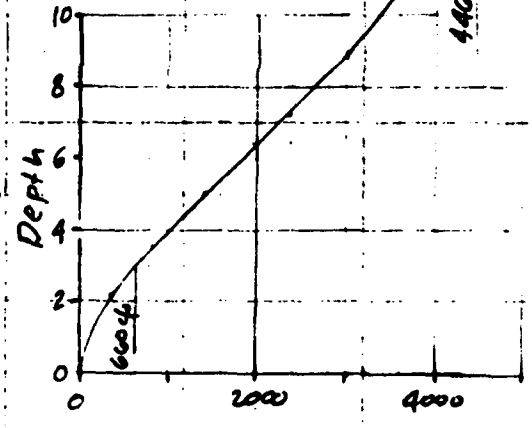
Disch. w/ Pond @ El. 61± = 660 cfs ∴ Tot. Failure Q = 4460 cfs

Storage Volume Released:

Storage Above Spillway	(61 − 57.5±) 23.4 =	47	ac. ft
Storage Below Spillway	$\frac{1}{3}$ (11) 23.4 =	86	"
S = Total Storage =		133	ac ft

By Using Hydraulics:
Same as (III) C :

H/d	0.3	0.5	0.7	0.9
q	9.5	21	36	51
Q_a	370	820	1400	1990
Depth	2.1	3.6	5.0	6.4
Elev. @ Bridge	48	49.5	50.9	52.3



Failure under above test conditions raises depth at bridge from ± 3' to ± 14', with a minor flow over Whittenton St. 14 ft depth @ bridge equals elev. ±60, which is only one foot below the assumed level in the pond. The street embankment would act as a secondary dam, limiting discharge downstream.

Time to Drain:

$$\frac{43560\ (133)}{3600\ (\frac{1}{2})\ (3800\ )} = 0.85 \text{ Hours. or } 51 \text{ minutes}$$

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

END

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6-85

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